Coupling of carbon, nitrogen and oxygen cycles in sediments from a Mediterranean lagoon: a seasonal perspective

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Résumé en anglais	Experimental data and simulations were used to investigate the seasonal coupling between carbon, nitrogen and oxygen cycles in marine sediments from a eutrophic shallow lagoon in the Mediterranean Sea area. A negative seasonal correlation was observed between oxygen consumption and coupled nitrification–denitrification rates in surface sediments. Elevated values of oxygen consumption rates were reached during warm periods (up to 87.7 mmol m–2 d–1) whereas nitrification and denitrification rates remained close to the lowest rates reported for coastal sediments (values around 0.021 to 0.35 mmol N m–2 d–1 for nitrification and 0.014 to 0.045 mmol N m–2 d–1 for denitrification). A steady-state diagenetic model closely represented the seasonal negative correlation of oxygen uptake, coupled nitrification–denitrification rates, the vertical distribution patterns of pore water oxygen and the solid phase distribution of organic carbon when nitrification inhibition by sulfide was included. Simulation adjusted to field data also highlighted the importance of oxygen penetration depth in the seasonal variation of nitrification. The modelling indicated that anaerobic metabolism was the most significant pathway (65 to 80%) during organic matter mineralization with a clear seasonal increase during warm periods. These warm periods were also characterized by the higher benthic demand of oxygen mostly used to re-oxidize the by-products from anaerobic reactions (from 57 to 82%), the other part being used for carbon mineralization
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